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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **Improvements in and to diamond segments and inserts.**

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BE-A- 568 518
DE-A- 3 340 480
FR-A- 1 104 941
JP-A-57 201 119
US-A- 3 016 661
US-A- 3 711 999

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Description

This invention relates to a cutting tool with diamond segments used as milling cutters and saws for the cutting and the polishing of granites, stones, marbles, concrete, asphalt or analogous hard materials.

In a tool for milling cutters and saws, a certain number of segments are welded on a steel support and the whole is called tool where the segments are the cutting part.

For being considered as optimum, these segments must have various requisites, among which such mechanico-structural characteristics as to enable obtaining perfectly linear cuts without chippings on the edges of the material to be cut.

Furthermore, it is useful for the cutting to be carried out quickly in order to ensure the smallest possible consumption of current during the work and to enable reducing the operating costs whereas the segment should be worn out uniformly along the cutting surface in order to have a satisfactorily long life.

The segment has also to aid in reducing as much as possible the noise during the cutting and, in some cases, it should also enable to obtain a good surface polishing of the cut material.

All these requisites are very important in the tools of this type; but they are never present all of them in the same tool.

The object of the invention is to provide a segment which will possess all the characteristics mentioned above and at the same time will be of low cost of production, contrarily to other segments existing on the market which are very expensive and enable to obtain only some of the advantages mentioned hereinabove.

Among the known segments there are, for example, the so-called sandwich segments formed by an inner layer of soft material enclosed between outer layers of a more resisting material or between two outer layers having a higher concentration of diamonds as compared with that of the inner layer. This segment, very expensive to manufacture in both cases, enables to obtain an even surface wear of the segment without rounding off the edges, but does not possess any of the characteristics mentioned above.

This applies to the segments which are cut centrally or axially (see BE-A 568 518) or are provided with grooves (see also FR-A 1 104 941) which segments though providing a good cooling during the cutting, have a very high cost of production and are subjected to an irregular and quick wear.

For attaining these and other objects which will be more alearly apparent from the following description, the claimed invention provides a cutting tool for the cutting of hard materials comprising: a supporting disk, a plurality of hardened segments uniformly disposed around the periphery of the supporting disk, each segment including a first and second main surface that are disposed substantially parallel to each other, the distance between the main surfaces defining the segment's thickness, the main surfaces of the segments being disposed perpendicular to the longitudinal axis of the supporting disk, characterized in that the first main surface of the segments includes a plurality of uniformly spaced dead holes shaped and distributed in such a manner that all the cross-sections perpendicular to the longitudinal axis of the segment originate full surfaces whose areas are all of them substantially equal to one another and in constant ratio with the rated cross-section of the segment, whatever the degree of wear of the segment may be.

Additional features of the invention are described in the dependent claims.

An embodiment of the segment according to the Invention will now be described with reference to the annexed drawing, in which:

Figure 1 is a front view of the segment according to the invention in a preferred embodiment thereof;

Figure 2 and 3 are cross-sections along line II–II and III–III of fig. 1;

Figure 4 is a partial view a tool carrying the segments according to the invention;

Figure 5 is a partial view of the segment of fig. 4 in the direction of the arrow A;

Figures 6, 7 and 8 show further configurations of the segment according to the invention;

Figure 9 is an enlarged view of a detail of the segment shown in figure 5.

The diamond segment 10 accordingly to the invention is provided with a recess 11 formed on one of its main surfaces. These recesses, in the embodiment shown in figures from 1 to 5, have a quadrilateral cross-section and are distributed obliquely in both directions relative to the orthogonal axes of the segment.

This is carried out according to the invention in such a manner that in whatever portion of the tool a cross-section is made (see for example the cross-sections II–II and III–III of figures 2 and 3), global full surfaces S of substantially equal area are obtained, independently of the way the recesses 11 are positioned therein.

Moreover, according to the invention the segments 10 are mounted on the supporting disk 12 in such a manner that on each face thereof there will appear alternately the full surface 13 and the surface provided with holes 11, as shown in fig. 4. In other cases, also two segments turned in a direction could alternate with as many segments turned in the opposite direction.

Furthermore, according to the invention the holes 11 have a depth p (figures 5 and 9) greater than the half s/2 of the thickness of the segment itself, and more advantageously a depth equal to about 2/3 of s.

The represented distribution of the holes 11 ensures that during the work, and accordingly during the wear of the segment this latter will always keep such a structure that the surfaces S of its vertical cross-sections, though being reduced, will remain substantially equal to each other till the complete wear of the segment.

This gives rise to an optimum cutting balance of the tool and conquently a more homogeneous and correct wear thereof.

Moreover, the openings 11 which always appear on the cutting surface the segment (see fig. 5) permit a high cutting speed thanks to the reduction of the metal friction surface as compared with a solid segment and hence a smaller consumption of current, the material to be cut being equal.

The cut is optimum and the segments wears out uniformly on the cutting surface, inasmuch as, according to the invention, the depth of the slots 11 which appear on the cutting surface is greater than half the thickness of the segment and the segments are alternately turned through 180° on the disk. Accordingly, during the work the global cutting surface formed by the sum of the cutting surfaces of all the segments has an intermediate linear portion having the width 2 (p–s/2) which extends from the two sides of the center line x of the cutting surface, whose area is smaller than that of the two portions s–P which lie laterally with respect to it.

In this way, although all the segments are formed by a single alloy of materials, a total cutting surface of the sandwich-type segment is obtained in which the side portions having, both of them, a thickness s–p, have a surface larger than the intermediate surface whose thickness is 2 (p–s/2), and accordingly the result is that the side edges are more resisting than the center line, which gives rise to a uniform linear wear of the segment with no excessive roundings along the edges.

The presence of the openings 11 on the cutting surface of the segment gives rise also to a reduction of the cutting noise because, thanks to the discontinuites of the surface, the vibrations are not transferred towards the steel support, but extinguish in the holes of the segments.

If, in addition thereto, the holes 11 are filled with an aphonous material, the cutting tool becomes even more noiseless during the working, whereas if the material with which the holes are filled is of the abrasive or superabrasive type the segment provides a smoothing and a perfect polishing of the machined surface which in many cases does not require any further working.

As already pointed out, the balancing of the segments is a foundamental feature and is obtained, according to the invention, by distributing the holes 11 in such a way that the surfaces of all its vertical cross-sections are of equal quadrature, both when the segment is a new one and when it gradually wears.

This is obtained, according to the preferred embodiment shown in fig. 1, with quadrilateral holes positioned obliquely relative to the axes of the segment, but it can be obtained also with other types of holes 11, for example round (fig. 6) or oval elongated (fig. 7) or triangular (fig. 8) or of any other shape, provided they are positioned and distributed in such a manner as to enable to always obtain the balancing effect mentioned hereinabove.

Claims

1. A cutting tool for the cutting of hard materials comprising: a supporting disk (12), a plurality of hardened segments (10) uniformly disposed around the periphery of the supporting disk (12), each segment (10) including a first and second main surface that are disposed substantially parallel to each other, the distance between the main surfaces defining the segment's thickness, the main surfaces of the segments (10) being disposed perpendicular to the longitudinal axis of the supporting disk (12), characterized in that the first main surface of the segments (10) includes a plurality of uniformly spaced dead holes (11) shaped and distributed in such a manner that all the cross-sections perpendicular to the longitudinal axis of the segment (10) originate full surfaces whose areas (S) are all of them substantially equal to one another and in constant ratio with the rated cross-section of the segment (10), whatever the degree of wear of the segment may be.

2. A tool as claimed in claim 1, characterized in that the holes (11) are turned and distributed in an oblique manner relative to the vertical and longitudinal axes of the segments (10).

3. A tool as claimed in claim 1, characterized in that the depth (p) of the holes (11) is greater than the half of the thickness (s) of the segment (10).

4. A tool as claimed in claim 3, characterized in that the depth (p) of the holes (11) is equal to about two thirds of the thickness (s) of the segment (10).

5. A tool as claimed in claim 1, characterized in that each segment (10) is arranged at 180° with respect to the first main surface of an adjacent segment (10).

6. A tool as claimed in claim 1, characterized in that the cross section of the holes (11) is quadrilateral.

7. A tool according to claim 1 where the cross section of the holes (11) is circular.

8. A tool according to claim 1 where the cross section of the holes (11) is oval.

9. A tool according to claim 1 where the cross section of the holes (11) is triangular.

Patentansprüche

1. Ein Schneidwerkzeug zum Schneiden von hartem Material bestehend aus: einer Haltescheibe (12), einer Anzahl gehärteter Segmente (10), die um den äußeren Umfang der Haltescheibe (12) gleichförmig angeordnet sind; jedes Segment (10) bildet eine erste und zweite Hauptoberfläche, die parallel zueinander angeordnet sind und die Entfernung zwischen ihnen ergibt die Stärke des Segments; die Hauptoberflächen der Segmente (10) sind senkrecht zur Längsachse der Haltescheibe (12) angeordnet, dadurch gekennzeichnet, daß die erste Hauptoberfläche der Segmente (10) eine Reihe gleichmäßig voneinander entfernter blinder Bohrungen (11) aufweist, die so geformt und angeordnet sind, daß alle Querschnitte senkrecht zur Längsachse des Segments (10) volle Oberflächen ergeben, deren Flächeninhalte (S) alle identisch sind und

in einem gleichen Verhältnis stehen zum geeichten Querschnitt des Segments (10) und zwar unabhängig davon, wie abgenutzt das Segment ist.

2. Ein Werkzeug nach Anspruch 1, dadurch gekennzeichnet, daß die Bohrungen (11) schräg zur Senkrecht- und Längsachse der Segmente (10) ausgerichtet und angeordnet sind.

3. Ein Werkzeug nach Anspruch 1, dadurch gekennzeichnet, daß die Tiefe (p) der Bohrungen (11) um die Hälfte größer als die Stärke (S) des Segments (10) ist.

4. Ein Werkzeug nach Anspruch 3, dadurch gekennzeichnet, daß die Tiefe (p) der Bohrungen (11) ca. zwei Dritteln der Stärke (S) des Segments (10) entspricht.

5. Ein Werkzeug nach Anspruch 1, dadurch gekennzeichnet, daß jedes Segment (10) um 180° im Vergleich zur ersten Hauptfläche eines benachbarten Segments (10) angeordnet ist.

6. Ein Werkzeug nach Anspruch 1, dadurch gekennzeichnet, daß der Querschnitt der Bohrungen (11) vierseitig ist.

7. Ein Werkzeug nach Anspruch 1 wobei der Querschnitt der Bohrungen (11) rund ist.

8. Ein Werkzeug nach Anspruch 1 wobei der Querschnitt der Bohrungen (11) oval ist.

9. Ein Werkzeug nach Anspruch 1 wobei der Querschnitt der Bohrungen (11) dreieckig ist.

Revendications

1. Outil de coupe pour couper des matériaux durs comprenant: un disque de support (12), plusieurs segments durcis (10) disposés uniformément autour de la périphérie du disque de support (12), chaque segment (10) comprenant une première et une deuxième surfaces principales, qui sont disposées sensiblement parallèles l'une à l'autre, la distance entre les surfaces principales définissant l'épaisseur du segment, les surfaces principales des segments (10) étant disposées perpendiculairement à l'axe longitudinal du disque de support (12), caractérisé en ce que la première surface principale des segments (10) comprend une pluralité de logements borgnes (11) régulièrement espacés, formés et répartis de telle manière que toutes les sections transversales perpendiculaires à l'axe longitudinal du segment (10) engendrent des surfaces pleines, dont les aires (S) sont toutes sensiblement égales l'une à l'autre et en rapport constant avec la section transversale théorique du segment (10), quel que soit le degré d'usure du segment.

2. Outil selon la revendication 1, caractérisé en ce que les logements (11) sont tournés et répartis de manière oblique par rapport aux axes vertical et longitudinal des segments (10).

3. Outil selon la revendication 1, caractérisé en ce que la profondeur (p) des logements (11) est supérieure à la moitié de(s) l'épaisseur(s) du segment (10).

4. Outil selon la revendication 3, caractérisé en ce que la profondeur (p) des logements (11) est égale à environ les deux tiers de(s) l'épaisseur(s) du segment (10).

5. Outil selon la revendication 1, caractérisé en ce que chaque segment (10) est disposé à 180° par rapport à la première surface principale d'un segment adjacent (10).

6. Outil selon la revendication 1, caractérisé en ce que la section transversale des logements (11) est en forme de quadrilatère.

7. Outil selon la revendiction 1, dans lequel la section transversale des logements (11) est circulaire.

8. Outil selon la revendication 1, dans lequel la section transversale des logements (11) est ovale.

9. Outil selon la revendication 1, dans lequel la section transversale des logements (11) est triangulaire.

Fig.1

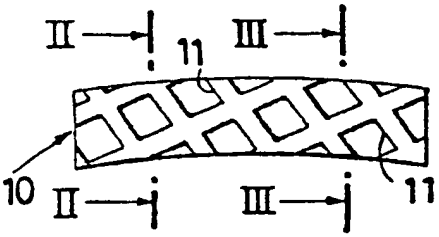


Fig.2

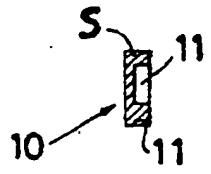


Fig.3

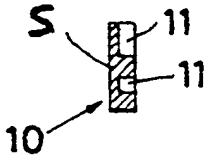
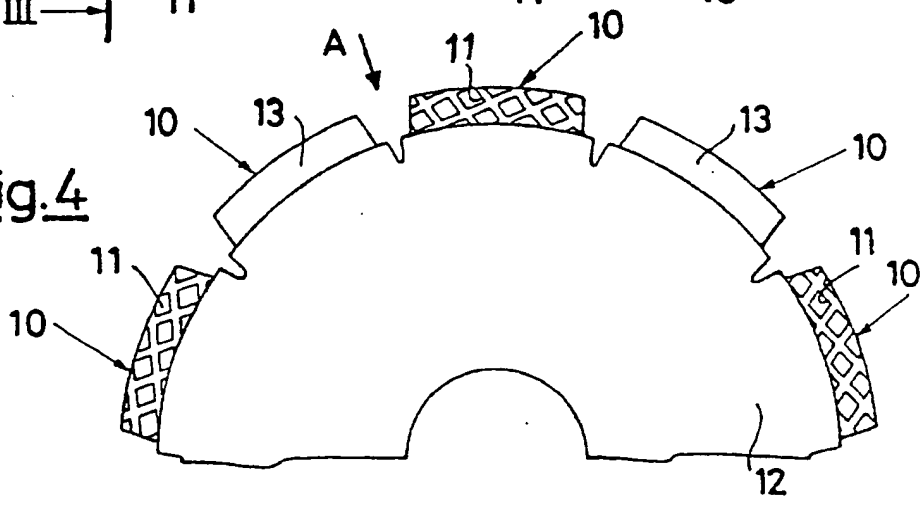


Fig.4



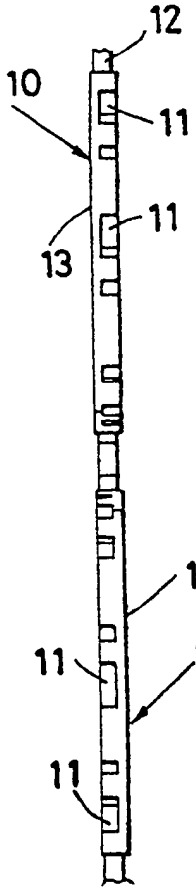


Fig.5

Fig.6

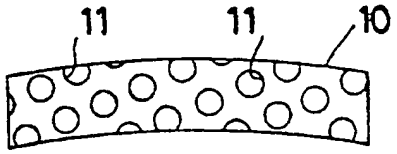
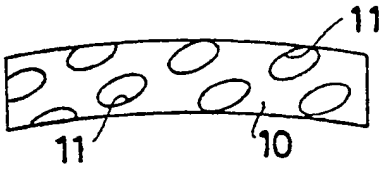


Fig.7



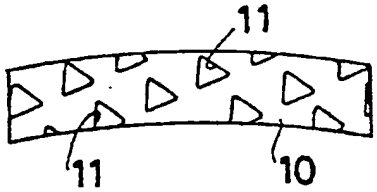


Fig.8

Fig.9